of generic and specific variation should also be applicable in explanation of certain plants and insects of constant character, being discovered confined to various geological soils within the radius of their distribution, or to favourite haunts postulating more than simple dispersion from a centre. And the pale blue of butterflies frequenting limestone and chalky downs need evoke no interference in the law of albinism if the honeyed cowslips and downy oxlips over whose leaves they flutter are, as reputed by Linnæus and Prof. Henslow, specifically identical with the shadow-seeking primrose, and may be raised from the same root. So likewise the local feature of melanism may be regarded as not only manufacturing annual varieties, but as pervading the black, brown, and drab tribes of the Alpine, Arctic, and woodland faunas, and may give a reason for their dark trait of beauty."

We give up the above in despair of extracting its meaning, if it has any; and cannot but regret that a book so full of valuable facts and good observations should be spoilt by constant efforts at philosophical disquisition, for which the tone of mind of the writer quits unfits him.

WEAPONS AND POLITICS OF THE ANCIENT HINDUS

On the Weapons, Army Organisation and Political Maxims of the Ancient Hindus, with Special Reference to Gunpowder and Firearms. By Gustav Oppert. (Madras: Higginbotham and Co.; London: Trübner and Co., 1880.)

"WHILE pursuing my researches into ancient Indian history," says Dr. Oppert, "I lighted upon two ancient Sanskrit manuscripts containing interesting information on many new and important topics. One of them, the Nītiprakā'sikā, has been, I believe, up to now utterly unknown, and the other, the 'Sukranīti, though known to exist, has never been described and published." The manuscripts relate to the weapons and military organisation of ancient India, a subject upon which fresh light was much needed If for no other reason, therefore, they deserved to be edited and translated. But one of them at least also contains statements sufficiently novel and startling to claim for them a special hearing. If we may believe it, not only was gunpowder invented in India long before the days of Berthold Schwarz or Roger Bacon, but firearms, including both cannon and guns, were known and used. The guns were even provided with sights and flints. "The tube" of one of them, it is said in the Sukranīti, "is five spans long, its breech has a perpendicular and horizontal hole, at the breech and muzzle is always fixed a sesame-bead for aligning the sights. The breech has at the vent a mechanism which, carrying stone and powder, makes fire by striking. Its breech is well-wooded at the side, in the middle is a hole, an *angula* broad; after the gunpowder is placed inside, it is firmly pressed down with a ramrod. This is the small gun which ought to be carried by foot-soldiers. . . A big gun is called (that gun) which obtains the direction of the aim by moving the breech with a wedge; its end is without wood; but it is to be drawn on cars. . . . The ball is made of iron, and has either small balls in its inside or is empty." Dr. Oppert believes that the Nītiprakā'sikā also contains references to firearms, though the passages he quotes seem rather to refer to supernatural weapons or to fire-machines like those used by the Greeks of the Eastern Empire. A work, too, which mentions the Hunas ("Huns," or Europeans) cannot be of the antiquity to which he would assign it.

Dr. Oppert seeks further support for the early use of firearms in India in a passage from a portion of the Atharvanarahasya, which he renders: "the fire prepared by the combination of charcoal, sulphur, and other material depends upon the skill of its maker." It is plain, however, that there is no necessary allusion to gunpowder in these words, much less to firearms. A quotation from Manu, in which fighting with "darts kindled by fire" is forbidden, is equally inconclusive.

The statements of the 'Sukranīti must therefore stand by themselves. In spite of Dr. Oppert's arguments to the contrary, it is difficult to admit that in its present form it can be earlier than the thirteenth century. The prohibition to use firearms in "fair" fighting would not account for the total absence of any reference to them in the law-books and epics and other literature of ancient India, and had they existed in the seventh century, or had the Hindus been acquainted with gunpowder at that time, we can hardly suppose that the fact would have remained unknown to the inquisitive Buddhist pilgrims from China who have left us accounts of their travels in the Peninsula. The Greek fire had nothing to do with gunpowder, and we do not therefore see why Dr. Oppert introduces it into the discussion, while there is no proof that the *manjanīk* or machine employed by Mohammed Kasim at the siege of Daibal (A.D. 711) was propelled by gunpowder. The flaming thunderbolts launched by the Indians against the army of Alexander, according to the pseudo-Aristotle, belong to the region of myth, like the storms of lightning with which Herakles and Dionysos were received when they invaded India, as related in the romance of Philostratos. Gunpowder may indeed have been invented in India, as Beckmann believed, but if so we want further evidence before we can admit that the invention was earlier than the twelfth or thirteenth century of our era.

Among other interesting points noticed by Dr. Oppert are the (ideal) rate of pay received by the officers and privates of a Hindu army at the time the Nītipraka sika was composed, and the identification of Manipura, the capital of the Pandya kings, with the modern Madura. He also points out that the boomerang is well known in many parts of India, especially in the south, and that he himself possesses four wooden ones, besides an iron one, which he obtained from Pudukoṭa. Two ivory ones, from the armoury of the late Rajah of Tanjore, are preserved in the Madras Museum. The Tamil name of the boomerang is *valai tadai*, or "bent stick," and it is employed in hunting deer. It is one of the weapons described in the Nītipraka sika under the name of *astara* or "scatterer."

OUR BOOK SHELF

Lehrbuch der organischen Qualitativen Analyse. Von Dr. Chr. Th. Barfoed. (Kopenhagen: Andr. Frest und Sohn, 1880.)

THERE is no branch of qualitative chemical analysis in such an unsatisfactory condition as that which deals with organic acids and bases. The plans on which examina-

tions in practical chemistry are generally conducted are probably largely to blame for this unsatisfactoriness. Examiners require a knowledge of the separation and identification of organic acids, in addition to the ordinary power of analysing a mixture of inorganic substances; one day is probably considered sufficient time to devote to the examination. Candidates must make themselves acquainted with a few of the tests for organic acids; they find these in all the text-books of analysis; they repeat the tests, and manage to stumble through the examination. The truth is that the detection of organic compounds, even when but a few of these are present, is far too complex and difficult a process for repetition in the hurry and bustle of the examination-room. Were all organic compounds omitted from the examinations in practical chemistry at the leading schools of medicine and science, we have no doubt that in a few years the processes for detecting these compounds would be largely improved.

We should strongly advise all students who wish to acquire just that amount of knowledge of organic analysis which may perhaps enable them to pass an examination *not* to procure Dr. Barfoed's book, and as strongly advise all who wish to study this branch of analysis in a thorough and accurate manner to procure the book, or rather that part of it which is now published, at once. The publishers of this work announce that the book will be completed in three parts; if the second and third are as fully and accurately compiled as the first, the book will undoubtedly be the standard work of reference in the department of organic qualitative analysis.

The first part, extending to 192 pp., contains the more important acids, cellulose and starch. A full account is given of the properties and reactions of each compound so far as these are of value in qualitative analysis; methods of separation, varying according to the conditions of complexity of mixtures, are also given. The book is not arranged after the ordinary plan of the text-books of inorganic analysis; it is rather a full and accurate store of information regarding the reactions of organic compounds from which the student may select materials according to the special conditions of the problem presented to him.

The work contains no preface or indication of the ground to be covered by the completed book; judging however from the scope of the first part, the author would seem to aim at presenting a complete account of the reactions of all those commonly occurring organic compounds which can, with a fair degree of certainty, be identified by qualitative analysis.

A Synopsis of Elementary Results in Pure and Applied Mathematics; containing Propositions, Formulæ, and Methods of Analysis, with Abridged Demonstrations. By G. S. Carr, B.A. Vol. i. Pp. xxiv. 256. (London: C. Hodgson and Son, 1880.)

WE shall not enter upon any discussion as to the utility or inutility of such a work as the present, but simply confine ourselves to an account of its contents. It is not a work of yesterday, for the author tells us that it is compiled from notes "made at various periods of the last fourteen years, and chiefly during the engagements of teaching." Mr. Carr's chief aim has been so to arrange his matter that the student may be assisted in the revision of bookwork, hence he generally confines himself to indicating the main features of a proof or to a mere reference to the theorems by which the proposition is proved. To aid in this end he has employed a system of cross-references, each article being numbered progressively in "large clarendon figures." A feature to which the author rightly draws attention is the compression he has attained without sacrificing clearness in his "last section, in which in the space of twenty-four pages are contained more than the number of propositions usually given in treatises on geometrical conics," together with clear large figures, and in most cases the demonstrations. This, we think, he has done well. This first part he divides into seven sections. The first contains a large collection of mathematical tables (Factor Tables, Values of the Gamma-function, and many other useful and frequently-recurring constants), in addition to an introduction on the C.G.S. system of units. Algebra is treated of in articles 1-380; Theory of Equations, 400-593; Plane Trigonometry, 600-859; Spherical Trigonometry, 870-910; Elementary Geometry, 920-1099; Geometrical Conics, 1151-1267. It will be seen from the above numbering that there are breaks; these have been "purposely made in order to leave room for the insertion of additional matter, if it should be required in a future edition, without disturbing the original numbers and references." It is obvious to object here that the new matter may not fit into the plan adopted in this edition.

Owing to causes which Mr. Carr names, the earlier part of his work contains a rather long list of errata; most of these are pointed out, but not all. The utility of such a work greatly depends upon its reliability for purposes of reference, and our confidence is somewhat shaken when, on opening the work casually, as we did at p. 6, we find "$\log_{10}\pi = 1{\cdot}4971499$, $\log_e\pi = 0{\cdot}6679358$," and this not corrected elsewhere.

Having carefully read the whole of the text, we can say that Mr. Carr has embodied in his book all the most useful propositions in the above subjects, and besides has given many others which do not so frequently turn up in the course of study. The work is printed in a good bold type on good paper, and the figures are admirably drawn.

Estudio Micrográfico ne Algunos Basaltos de Cuidad-Real. Par Don Francisco Quiroga. (Madrid, 1880.)

IN this memoir the author gives an account of the microscopic characters exhibited by the basalts of the volcanic district of the Campos de Calatrava, which basalts he shows to have been erupted in Tertiary times. These rocks appear to belong to Dr. Boricky's classes of the Nepheline-basalts and the Nephelinitoid-basalts, in the former of which the nepheline is fully crystallised, while in the latter it exists as a glassy base in which crystals are beginning to make their appearance. The primary minerals of these rocks are nepheline, augite, magnetite, and olivine, which may be regarded as their essential constituents, and apatite and hornblende, which the author regards as accessory or accidental constituents. The secondary or derivative minerals are kaholite, hinsuite, and hematite, magnetite, serpentine, and aragonite. The memoir is illustrated by a coloured plate of rock-sections.

Il Binomio di Newton. Per Ignazio Cameletti. 7 pp. (Genova, 1880.)

BY performing the successive multiplications and writing, after the following fashion—

$$\begin{array}{rll} (1+x)^m = 1+x & & (m=1 \\ \hline x+x^2 & & m=2 \\ \hline x+x^2 & & \\ x^2+x^3 & & m=3, \\ \hline \end{array}$$

and so on, the author succeeds in an ingenious manner, by summation of simple series, in getting the successive coefficients of the general expansion, and so proves his theorem, which is—

$$(a+b)^m = a^m + \Sigma_{p=1}^{p=m} \frac{m(m-1)\ldots(m-p+1)}{1\cdot 2\cdot\ldots\cdot p}\, a^{m-p}\, b^p$$

or the Binomial Theorem of Newton without having recourse to the doctrine of combinations.